Homework 10, DUE DUE Tue May 12, 2020, 3:30PM
NEED it done by Tue May 12 so can go over it on the last day
COURSE WEBSITE: `http://www.cs.umd.edu/~gasarch/858/S18.html`

1. (0 points) What is your name? Write it clearly.

2. (30 points) Show that Szemeredi's Theorem implies VDW's Theorem.

3. (30 points) Prove or disprove. You may assume VDW's theorem.

   (a) (15 points) For all $COL : \mathbb{N} \rightarrow [c]$ there exists, for all k, a mono k-AP AND the 3-AP, the 4-AP, the 5-AP, etc are all disjoint.

   (b) (15 points) For all $COL : \mathbb{N} \rightarrow [c]$ there exists a mono ω-AP (e.g., 10,15,20,... all the same color).

4. (40 points) A set A is *4-free set* if it does not have any arithmetic sequence of size 4.

   For this problem assume that, for all P, there is a 4-free set $A \subseteq [P]$ of size $Pe^{-(\log P)^f}$ for some constant f (your answer can be in terms of f).

   Alice, Bob, Carol, and Donna each have a string of length n on their foreheads The strings are a, b, c, d. Give a protocol for them to used such that

   - At the end they all know if $a + b + c + d = 2^{n+1} - 1$.

   - The number if bits communicated is $\ll n$.

   - Assume that your reader is a student in this class who MISSED the lecture on multiparty Communication (but she saw all of the prior lectures).

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